Clock Modules

→101979

MA1013 LED display digital electronic clock module

general description

The MA1013 Series Electronic Clock Modules combine a monolithic MOS-LSI integrated clock circuit, 4-digit 0.7" LED display, power supply and other associated discrete components on a single printed circuit board to form a complete electronic clock movement. The user need add only a transformer and switches to construct a pretested digital clock for application in clock-radios, alarm or instrument panel clocks. Timekeeping may be from 50 or 60 Hz inputs and 12 or 24 hour display formats may be chosen. Direct (non-multiplexed) LED drive eliminates RF interference. Time setting is made easy through use of "Fast" and "Slow" scanning controls.

Features include 150 mA radio supply switch, alarm output switch, alarm "on"' and "PM" indicators, blinking colon, "sleep" and "snooze" timers and variable brightness control capability. Power failure is indicated by flashing the display at a 1 Hz rate.

The MA1013 is capable of directly replacing the MA1012, allowing upgrading to 0.7" display.

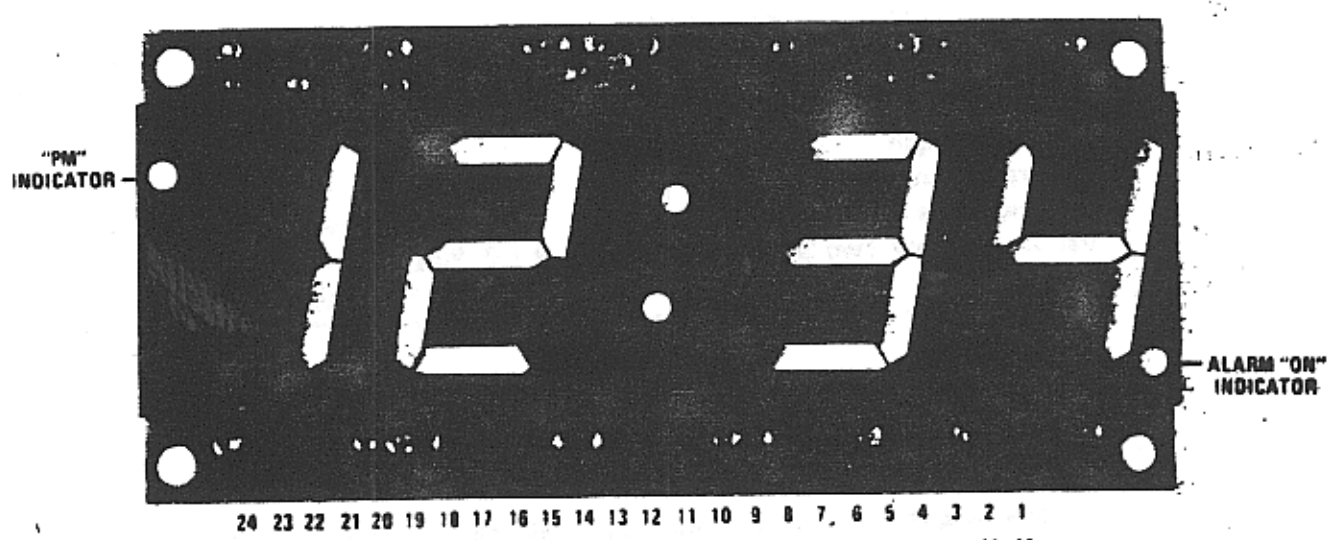
features

- Bright 4-digit 0.7" LED display
- Complete - add only transformer and switches
- 150 mA radio B+ switch
- Alarm output switch
- 12 or 24 hour display format
- 50 or 60 Hz operation
- Power failure indication
- Brightness control capability
- "Sleep" and "snooze" timers
- Alarm "on" and PM indicators
- Direct drive – no RFI
- Fast and slow set controls
- Low cost, extremely compact design
- Directly replaces MA1012

applications

- Clock-radio timers
- Alarm clocks
- Desk clocks
- TV-stereo timers
- Instrument panel clocks/timers

connection diagram



absolute maximum ratings

Voltage – Pins 15 to 13	20 Vrms
Voltage – Pins 1, 2 to 13	7.0 Vrms
Voltage – Pins 9 to 13	+0.3 to $-26V_{DC}$
Voltage – Pins 8, 10 to 9	30 V_{DC}
Operating Temperature Range	$-20°C$ to $+60°C$
Storage Temperature Range	$-20°C$ to $+70°C$
Lead Temperature (Soldering, 10 seconds)	$300°C$

electrical characteristics

$T_A = 25°C$; Pins 15 to 13 = 16 Vrms; Pins 1, 2 to 13 = 5.0 Vrms, unless otherwise specified.
Normal operating conditions allow Pins 15 to 13 to vary between 14 and 18 Vrms; Pins 1, 2 to 13 to vary between 4.2 and 6.5 Vrms.

PARAMETER		CONDITIONS	MIN	TYP	MAX	UNIT
V_{DD}	MOS Supply Voltage	V_{SS} = 0V	-18	-22	-25	V_{DC}
I_{15}	MOS Power Supply Current	100% Display Brightness		14	18	mA_{D}
I_{15}	MOS Power Supply Current	Display Off		3	5	mA_{D}
	LED Power Supply Current	100% Display Brightness (20:08)		250	280	mA
V_{DD}	Power Failure Indication Voltage	V_{SS} = 0V		-5	-8	V_{DC}
	LED Segment Display Current	Short Pin 7 to Pin 14 (R = 0Ω)		11		mA
		R = 12K		1.2		mA
		R = ∞		0.0		mA
$V_{CE_{SAT}}$	Radio Output	I_C = 150 mA		0.1	0.3	V
$V_{CE_{SAT}}$	Alarm Output	I_C = 15 mA		0.1	0.3	V
	Power Dissipation	100% Display Brightness (20:08) Max Input Voltage			2.3	w

optical characteristics

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNIT
Luminous Intensity Per Segment	I = 11 mA_{DC}	100	300		μcd
Peak Wavelength			660		nM
Spectral Width	Half-Intensity		40		nM
Viewing Angle	1/2 Brightness Point	±60			degree
Variation – Any Two Segments	R = 0, Pins 7 to 14			2:1	
	R = 4.3K, Pins 7 to 14			2:1	

functional description

Display Modes

The MA1013 provides four basic selectable display modes: These are summarized in Table I.

Colon: 12 hour display models (MA1013A, B) are furnished with a colon display which flashes at a 1 Hz rate. (Fixed colon units are available on special order.) 24 hour display models (MA1013C, D) are furnished with fixed colons.

Alarm "ON" Indicator: Setting the alarm switch to "on" lights a dot in the lower right hand corner of the display.

AM/PM Indicator: PM time indication is given by a dot in the upper left hand corner of the display (12 hour models only). Indication applies for both time and alarm display modes.

Power Failure Indication: Power failure is indicated by the entire display flashing at a 1 Hz rate. Contact to either the FAST or SLOW time set control cancels this indication.

Zero Blanking: Zeroes appearing in the first digit are blanked in both 12 and 24 hour display models.

Note: Additional information concerning device operation may be found on the MM5385, MM5386 clock circuit data sheet.

Control Functions

Setting of Time, Alarm Time, Seconds and Sleep Timer registers is accomplished by selecting the appropriate display mode and simultaneously contacting one or both of the FAST and SLOW time setting switches. This is summarized in Table II.

functional descriptions (con't)

Alarm On/Off Switch: The Alarm On/Off switch is an SPDT switch – the "ON" position lights the alarm set indicator; the "OFF" position disables the alarm output latch and silences the alarm. The alarm output will continue for 59 minutes unless cancelled by the Alarm On/Off switch or inhibited by the Alarm Display/Snooze button.

Alarm Display/Snooze Button: This momentary switch has four functions: displays the alarm time; enables setting of alarm time (in conjunction with fast or slow set switches); cancels the Sleep (Radio) output; and inhibits the alarm output for a period of between 8 and 9 minutes (Snooze function). The Snooze alarm feature may be used repeatedly during the 59 minute alarm enable period.

Sleep Display/Timer Button: A momentary contact displays the time remaining in the sleep register and enables programming the desired sleep time by simultaneously using the Fast or Slow buttons, as shown in Table II. The Sleep (Radio) output is latched on for the interval programmed, which may be up to 59 minutes. The Sleep output may be cancelled by momentarily contacting the Alarm Display/Snooze button. Resetting the time-of-day will decrement the Sleep Timer, which will not recycle past 00.

Brightness Control: Maximum display current is obtained by placing a short circuit between V_{DD} and the Brightness Control input. Insertion of a 10K potentiometer will reduce display brightness to a low level for night viewing, with an open circuit turning the display off completely. (Units with a fixed 12K brightness control resistor for use with an external SPST brightness control switch are available on special order.)

Outputs

Sleep (Radio): An NPN transistor controlled by the sleep timer. Both emitter and collector leads are available for use in switching a radio (or other appliance) power supply.

Alarm: An NPN transistor controlled by the alarm comparator and enable circuit. Both emitter and collector leads are available for switching an alarm circuit (or other circuit). If the emitter is returned to a source of 120 Hz ripple, such as a radio negative voltage supply, the collector may be coupled to an audio stage to produce a 120 Hz alarm tone.

NOTE

Certain outputs of the MA1013 module are directly connected to MOS device inputs. Normal precautions taken for handling of MOS devices should be applied to the handling of this module.

TABLE I. MA1013 DISPLAY MODES

*SELECTED DISPLAY MODE	DIGIT NO. 1	DIGIT NO. 2	DIGIT NO. 3	DIGIT NO. 4
Time Display	10's of Hours & AM/PM	Hours	10's of Minutes	Minutes
Seconds Display	Blanked	Minutes	10's of Seconds	Seconds
Alarm Display	10's of Hours & AM/PM	Hours	10's of Minutes	Minutes
Sleep Display	Blanked	Blanked	10's of Minutes	Minutes

*If more than one display mode input is applied, the display priorities are in the order of Sleep (overrides all others), Alarm, Seconds, Time (no other mode selected).

TABLE II. MA1013 CONTROL FUNCTIONS

SELECTED DISPLAY MODE	CONTROL INPUT	CONTROL FUNCTION
*Time	Slow	Minutes Advance at 2 Hz Rate
	Fast	Minutes Advance at 60 Hz Rate
	Both	Minutes Advance at 60 Hz Rate
Alarm/Snooze	Slow	Alarm Minutes Advance at 2 Hz Rate
	Fast	Alarm Minutes Advance at 60 Hz Rate
	Both	Alarm Resets to 12:00 AM (12 hour format)
	Both	Alarm Resets to (0)0:00 (24 hour format)
Seconds	Slow	Input to Entire Time Counter is Inhibited (Hold)
	Fast	Seconds and 10's of Seconds Reset to Zero Without a Carry to Minutes
	Both	Time Resets to 12:00:00 AM (12-hour format)
	Both	Time Resets to (0)0:00:00 (24-hour format)
Sleep	Slow	Subtracts Count at 2 Hz
	Fast	Subtracts Count at 60 Hz
	Both	Subtracts Count at 60 Hz

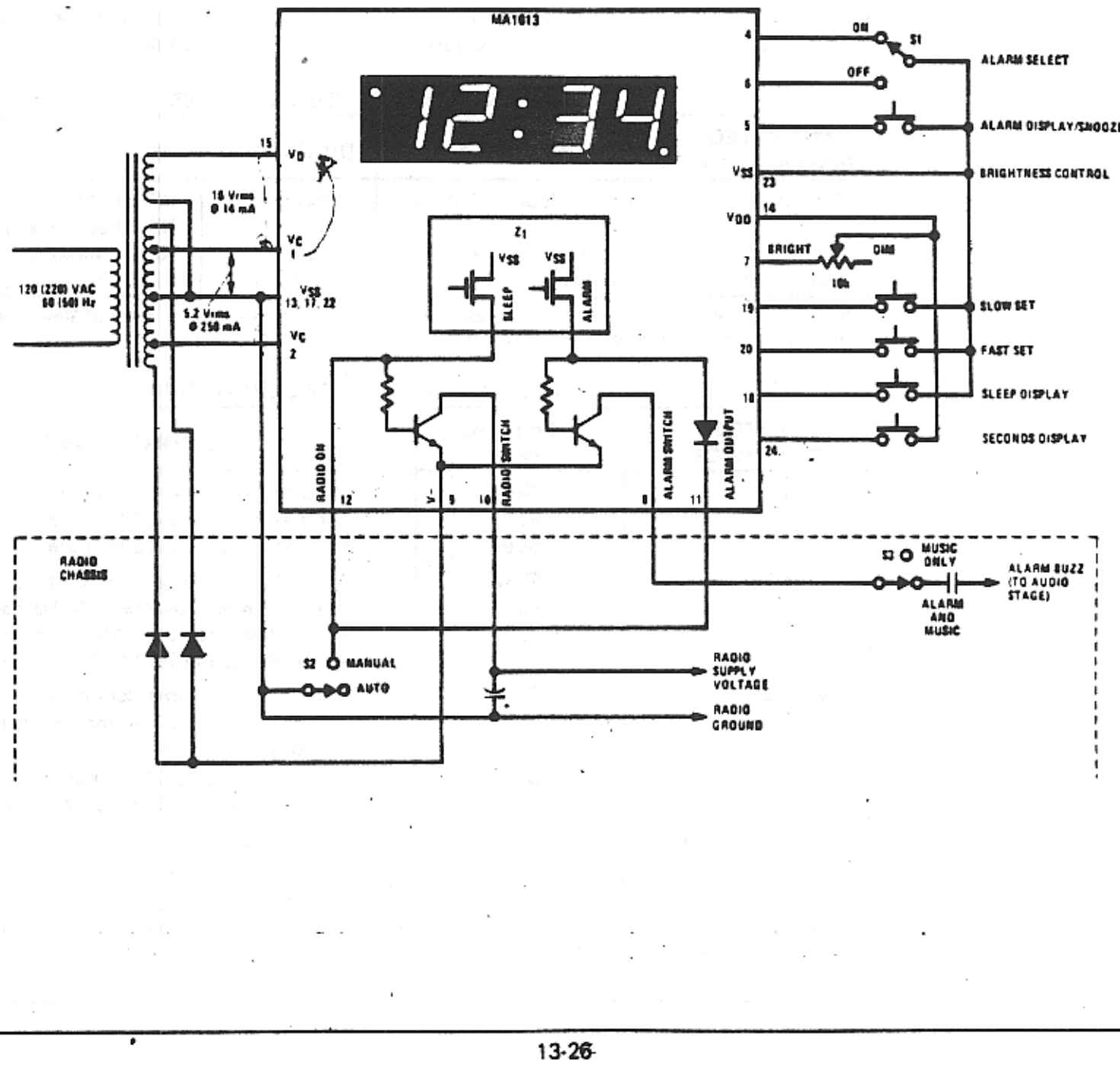
*When setting time sleep minutes will decrement at rate of time counter, until the sleep counter reaches 00 minutes (sleep counter will not recycle).

module selection guide

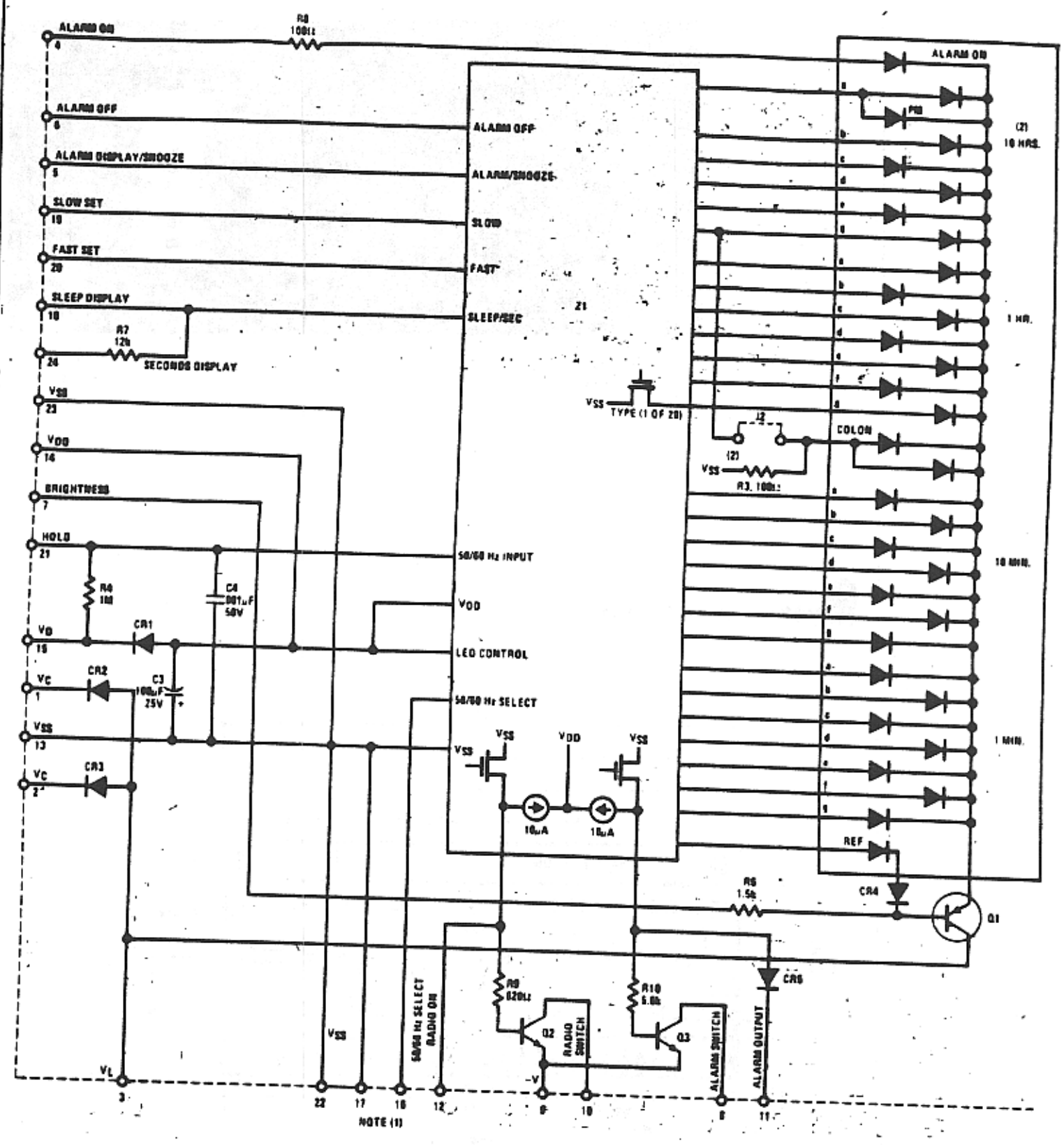
PART NUMBER	LINE FREQUENCY	DISPLAY HOURS
MA1013A	50/60	12
MA1013C	60/60	24

Note: For 50 Hz operation connect pins 16 and 17.

applications information



schematic diagram



Note 1: For 50 Hz operation, connect pins 16 and 17.

Note 2: For 12 hour display, use "PM," "b," "c" LED only (10 hour segment)
Z1 to be MM4391 (MA1013-A)
For 24 hour display, use "a," "b," "c," "d," "e," and "g," LED only (10 hour segment)
Use R3, do not use J2
Z1 to be MM4392 (MA1013-C)

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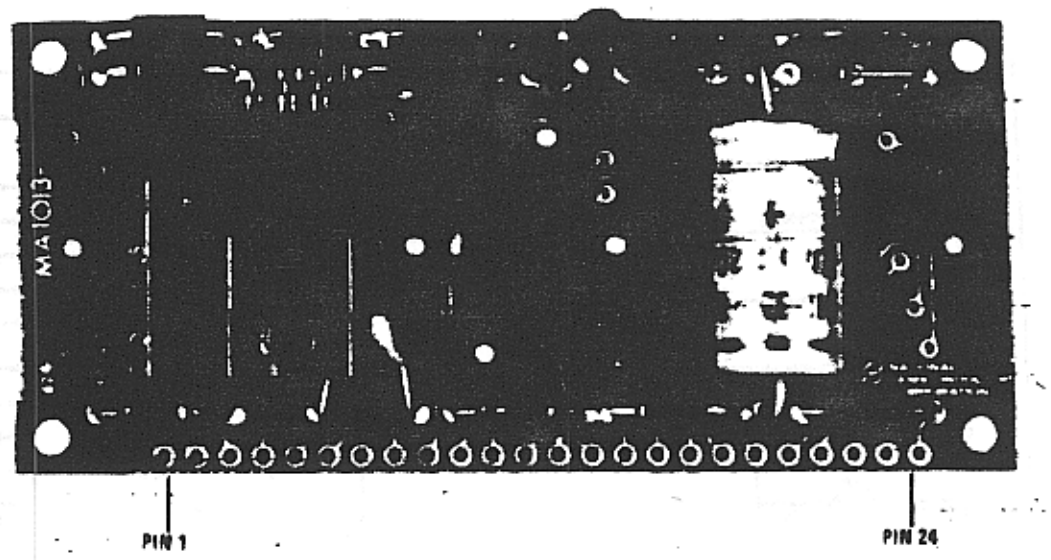
component side view



Physical dimensions